

Crystal growth mechanisms in miarolitic cavities in the Lake George ring complex and vicinity, Colorado

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ABSTRACT

The Crystal Peak area of the Pikes Peak batholith, near Lake George in central Colorado, is world-renowned for its crystals of amazonite (the blue-green variety of microcline) and smoky quartz. Such crystals, collected from individual miarolitic pegmatites, have a remarkably small variation in crystal size within each pegmatite, and the shapes of plots of their crystal size distributions (CSDs) are invariably lognormal or close to lognormal in all cases. These observations are explained by a crystal growth mechanism that was governed initially by surface-controlled kinetics, during which crystals tended to grow larger in proportion to their size, thereby establishing lognormal CSDs. Surface-controlled growth was followed by longer periods of supply controlled growth, during which growth rate was predominantly size-independent, consequently preserving the lognormal shapes of the CSDs and the small size variation. The change from surface- to supply controlled growth kinetics may have resulted from an increasing demand for nutrients that exceeded diffusion limitations of the system. The proposed model for crystal growth in this locality appears to be common in the geologic record, and can be used with other information, such as isotopic data, to deduce physico-chemical conditions during crystal formation.